

102-CD-001-004

## **EOSDIS Core System Project**

# **Development Configuration Management Plan for the ECS Project**

Revision 1

November 1995

Hughes Information Technology Corporation  
Upper Marlboro, Maryland

# **Development Configuration Management Plan for the ECS Project**

**Revision 1**

**November 1995**

Prepared Under Contract NAS5-60000  
CDRL Item 002

## **SUBMITTED BY**

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EOSDIS Core System Project	

**Hughes Information Technology Corporation**  
Upper Marlboro, Maryland

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# Preface

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This document is submitted as required by Data Item Description (DID) 102/MG1 for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS) contract. As an Approval Level 1 Contracts Data Requirements List (CDRL) item, this document requires Goddard Space Flight Center (GSFC) approval prior to its acceptance and use.

This document issue is a complete revision of the March 1994 version that was approved by Goddard Space Flight Center's Earth Science Data and Information System Project Organization (hereinafter referred to as "ESDIS"). It now contains only development phase information; hence the change in its title. A separate Maintenance and Operations Configuration Management Plan (102-CD-002-001) is being issued concurrently. This submittal contains new and changed material owing to changes in the Hughes Applied Information Technology (HITC) ECS organization and to current tools and processes. The document number has been changed to comply with the current Data Management (DM) numbering system.

All changes to this document shall be submitted for consideration by the contractor's ECS Change Control Board (CCB). Changes approved by the ECS CCB shall be submitted to ESDIS for final approval.

This document has been prepared in accordance with:

- *Earth Observing System Configuration Management Plan* (420-02-02)
- *Mission Operations and Data System Directorate Specification for Document Formats* (500-TIP-2110), March 1991
- *Software Documentation Standard, Software Engineering Program* (NASA-STD-2100-91), 29 July 91

This document is under ECS Project configuration control. Any questions or proposed changes should be addressed to:

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# Abstract

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This plan describes configuration management of the development of all software, documentation, hardware, and data for the ECS. It establishes policies, methodologies, and processes and describes ECS CM tools, organizations and change control boards. It defines plans for configuration identification, configuration control, status accounting and audits.

**Keywords:** CM, SDL, CCB, baseline, configuration, control, status, accounting, audit

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# Change Information Page

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Page Number		Issue	
Title		Revision 1	
iii through x		Revision 1	
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3-1 through 3-10		Revision 1	
4-1 through 4-20		Revision 1	
AB-1 through AB-4		Revision 1	
GL-1 through GL-4		Revision 1	
Document History			
Document Number	Status/Issue	Publication Date	CCR Number
101-102-MG1-001	Pre-Approved Release	May 1993	95-0667
193-102-MG1-001	Pre-Approved Release	September 1993	
194-102-MG1-001	Original	March 1994	
102-CD-001-004	Revision 1	November 1995	



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# 1. Introduction

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## 1.1 Identification of Document

This document is the *Configuration Management Plan for the ECS Development Project*. It is submitted as required by the Contract Data Requirements List (CDRL), Item 002, DID 102/MG1, for the EOSDIS Core System (ECS) contract. It meets the DID requirement for the ECS development phase. For maintenance and operations, a companion document, 102-CD-002-001, satisfies the DID.

## 1.2 Scope of Document

This Plan applies to all documentation, software, hardware, and data which will be supplied by HITC under the ECS contract. It implements requirements from the *Earth Observing System (EOS) Configuration Management Plan* (420-02-02), dated January 1990, as well as requirements from other applicable and guidance documents referenced herein. This Plan establishes all configuration management (CM) policies and methodologies relating to the ECS development phase. It describes the ECS organization(s) responsible for planning and implementing the ECS CM process; and the relationships among the EOSDIS Configuration Control Board (CCB) and the contractor's development Change Control Boards (CCBs). [NASA's convention is Configuration Control Board (CCB). ECS Project convention is Change Control Board (CCB).] In addition, this Plan defines the plans for ECS configuration identification, configuration control, configuration status accounting, and configuration auditing in an evolutionary environment.

This Plan is binding on Project subcontractors and applies to Commercial-off-the-Shelf (COTS) items integral to the ECS.

This document describes development configuration management processes at a summary level and references cognizant project instructions (PIs) which are regularly maintained to ensure continuous process improvement. The following is a list of relevant project instructions.

PI CM-1-003	Configuration Change Request Preparation
PI CM-1-004	Change Control Board Process
PI CM-1-006	Configuration Control - Deviations and Waivers,
PI CM-1-007	ECS Development Facility (EDF) Change Control Process
PI CM-1-008	Configuration Status Accounting and Reporting
PI CM-1-012	COTS Hardware and Software Configuration Control
PI CM-1-013	Government Requests for Impact Analysis
PI CM-1-024	Release and FOS Change Control Board Processes

PI CM-1-025	Software Development Handbook
PI CM-1-026	Change Control Accounting in CDMTS
PI DM-1-002	Documentation Numbering
PI DM-1-004	CDRL and Required Documentation Generation, Review, Release, and Maintenance
PI QO-1-014	ECS Project Metrics Process
PI SD-1-014	Nonconformance Reporting
PI SE-1-002	ECS Development Facility (EDF) Configuration Control
PI SE-1-004	RTM Database Standards and Procedures
PI SM-1-003	Change Administration Processing - Subcontractors

The following is a list of technical records referenced by this plan.

151-TR-001	HITC CCBs: Allocation of Authority and Responsibility
152-TR-002	ECS Document Control Matrix

### **1.3 Purpose and Objectives of Document**

The purpose of this plan is to establish the methodology for the ECS CM process in the contractor's development environment. The ECS CM process includes configuration identification, configuration control, configuration status accounting, and configuration audits.

The size and technical complexity of the ECS Project, together with the requirements for coordination and interfaces with ESDIS, the scientific community, Project segments, and subcontractors places emphasis on viewing the CM function as a provider of services to the ECS community. The objective of this Plan is to provide a CM environment which establishes configuration control at the appropriate level, ensures responsiveness, and minimizes schedule impacts which may result from the implementation of configuration changes.

### **1.4 Document Status and Schedule**

Three previous versions of the *Development Configuration Management Plan for the ECS Project* have been submitted to ESDIS for approval. GSFC comments on the May 1993 version were addressed in the September 1993 version. GSFC comments on the September 1993 version were addressed in the March 1994 version.

The *Maintenance and Operations Configuration Management Plan for the ECS Project* (102-CD-002-001) is being submitted concurrently with this document.

### **1.5 Document Organization**

This section describes the contents of each major section of this Plan and describes its relationship to other closely related ECS documents.

### 1.5.1 Section Contents

Except as described below, the format and contents of this document comply with NASA-DID-M600 and NASA-DID-999 as defined in NASA-STD-2100-91. Additional paragraphs and subparagraphs have been added in sections as appropriate to their volume and contents.

- Introduction — Introduces the Plan's scope, purpose, objectives, status, schedule, and document organization.
- Related Documentation — Provides a bibliography of reference documents for the ECMP organized by parent, binding, and information subsections.
- Configuration Management Process Overview — Provides an overview of the CM requirements within the ECS development environment, and outlines the ECS development Project's CM organizations and tools used in the CM process.
- Development Configuration Management Activities — Describes the Project's plans for the formal CM activities of configuration identification, configuration control, configuration status accounting, and configuration auditing for the development phase. The paragraphs described in NASA-DID-M600 have been reordered in order to describe the change control boards and their responsibilities earlier in the section.
- Abbreviations and Acronyms — Contains an alphabetized list of the definitions for abbreviations and acronyms used in this volume.
- Glossary — Contains an alphabetized list of definitions for special terms used in the volume.

### 1.5.2 Documentation Relationships

This Plan's principal parent document within the Project is the ECS *Project Management Plan* (101-CD-001-003).

The *Data Management Plan for the ECS Project* (104-CD-001-003) is a companion document to this plan. It describes the methodology for providing data management (DM) services necessary to create, control, deliver, archive, and update deliverable and non-deliverable documents and data; and to organize and provide easy access to these documents and data.

Specific details for both CM and DM are furnished to providers and users of CM and DM services in the form of Project Instructions (PIs). In order to simplify maintenance of individual instructions and to facilitate distribution to users, each PI will be treated as a stand-alone document. Accordingly, this plan refers to specific CM and DM PIs that will be improved and reissued as necessary to ensure continuous process improvement. Other PIs may be prepared and implemented if needed.

The *Software Development Plan for the ECS Project* (308-CD-001-004) and the *Performance Assurance Implementation Plan* (194-501-PA1-001) further address CM practices concerning product development.

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## 2. Related Documentation

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### 2.1 Parent Documents

The following documents are the parents from which this document's scope and content derive:

101-CD-001-004	Project Management Plan for the EOSDIS Core System, Revision 1, DCN No. 01
102-CD-002-001	Maintenance and Operations Configuration Management Plan for the ECS Project
107-CD-002-XXX	Level 1 Master Schedule for the ECS Project (Monthly)
420-02-02	Goddard Space Flight Center, EOS Configuration Management Plan
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS)
NASA-STD-2100-91	NASA Technical Standards Division Publication: Software Documentation Standard, Software Engineering Program [specifically NASA-DID-999, the Template DID; and NASA-DID-M600, the Configuration Management Plan DID]

### 2.2 Applicable Documents

The following documents are directly applicable to this plan to the extent referenced herein. In the event of conflict between any of these documents and this plan, the plan shall take precedence.

104-CD-001-003	Data Management Plan for the ECS Project
193-105-MG3-001	Data Management Procedures for the ECS Project
194-201-SE1-001	Systems Engineering Plan for the ECS Project
207-CD-001-001	System Design Specification for the ECS Project
308-CD-001-004	Software Development Plan for the ECS Project
194-501-PA1-001	Performance Assurance Implementation Plan for the ECS Project
194-505-PA3-001	Description of Contractor and Subcontractor Audit Programs for the ECS Project



## **2.3 Information documents**

The following documents, although not directly applicable, amplify or clarify the information presented in this document, but are not binding:

222-TP-003-008	Release Plan Content Description for the ECS Project
500-TIP-2110	Goddard Space Flight Center, Mission Operations and Data System Directorate Specification for Document Formats

## 3. Configuration Management Process Overview

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This section provides an overview of the ECS Project's CM requirements within the ECS environment, a description of the ECS Development Project's CM organization, and descriptions of the development CM tools. Details on the ECS Project's configuration identification, configuration control, configuration status accounting, and configuration auditing processes can be found in Section 4, Development Configuration Management Activities.

### 3.1 CM Requirements Within the ECS Environment

The purpose of the ECS CM process is to establish and control baselines, establish mechanisms for identifying and evaluating the cost, schedule and performance impacts of proposed changes to those baselines, and provide status reporting for all controlled configurations. To understand these requirements, however, it is necessary to understand the environment in which ECS will be developed.

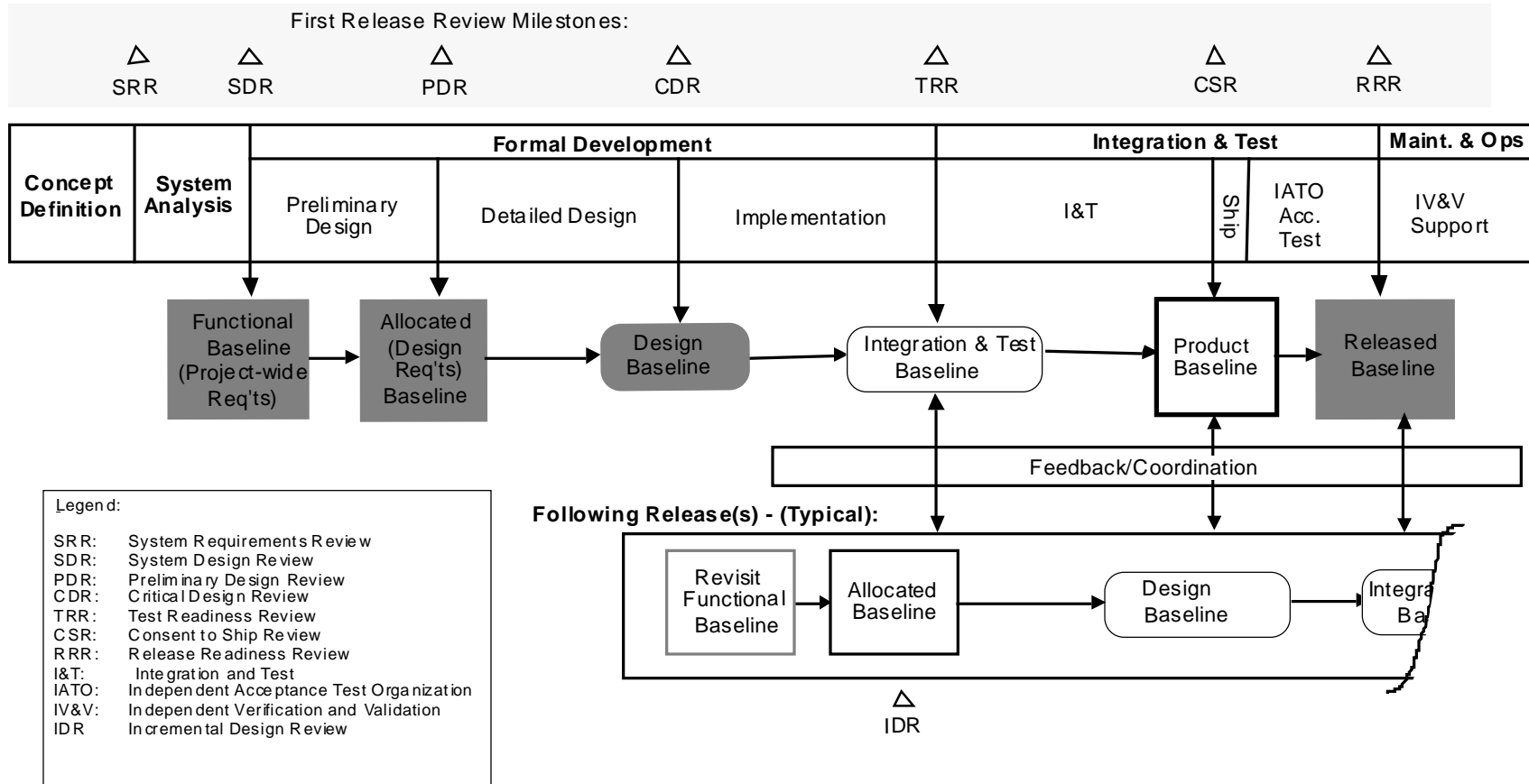
ECS is a vital component of the National Aeronautical and Space Administration's (NASA's) Mission to Planet Earth program and will be one of the world's largest and most complex information systems. ECS will be a distributed collection of institutional assets, facilities, and core system functions that work together to support EOS and Mission to Planet Earth. ECS is the overall integrating infrastructure for operations as well as a provider of data and information services for EOS mission support, science data processing, communications, and system management. It provides single-point access for a worldwide Earth science community, simultaneous mission management for multiple instruments, and regular production of validated science products from community-supplied science software. ECS is viewed as the evolutionary base for accelerating the pace and quality of Earth science research.

The following paragraphs provide an overview of major ECS issues.

#### 3.1.1 Multiple Releases and Simultaneous Baseline Management

The ECS consists of a number of phased Releases, to which all processes and policies described in this plan apply. Figure 3-1, ECS Baselining Activities, illustrates the ECS baselines, their relationships to major Project milestones defined in the *Level 1 Master Schedule for the ECS Project* (107-CD-001-XXX), and the phasing among Releases. The initial development and deployment process culminates in the installed baseline for the first Release. Subsequent ECS Releases are identified and defined by approved modifications, additions, and deletions to the baseline for the previous Release, so each successive released baseline is a composite of the new release and the preceding release. Due to the significant time periods between the Releases, requirements specifications, interface documents, hardware allocations, and other design data can be expected to change. In addition, as changes continue to be approved in the previous Release, they are individually evaluated by the ECS Project's development organizations for applicability to the new Release being developed. This process ensures that, when delivered, each later Release contains all of the applicable fixes and improvements which were incorporated into its predecessor Release(s).

**First Release:**



**Figure 3-1. Baselining Activities**

In addition, there is an Interim Release (IR1). IR1 is an early version of formal Release A that is delivered as a test bed for Earth Observing System (EOS) system interfaces before delivery of Release A. Although the interim release may not be subject to the same review schedule as major releases, it is subject to CM control in accordance with this plan. The ECS CCB charters an interim release CCB. All interim release requirements, documentation, procurements, software turnovers and deployments are under CCB control like major releases. Incremental track components of the interim release are handled informally until they merge with the formal track, just as for major releases. A copy of the IR1 software is maintained by CMO in the Software Development Library (SDL). Problems with the delivered IR1 are documented on Nonconformance Reports and dispositioned by the responsible CCB. Fixes are incorporated into both the formal Release and IR1 in the SDL and delivered to the operational site.

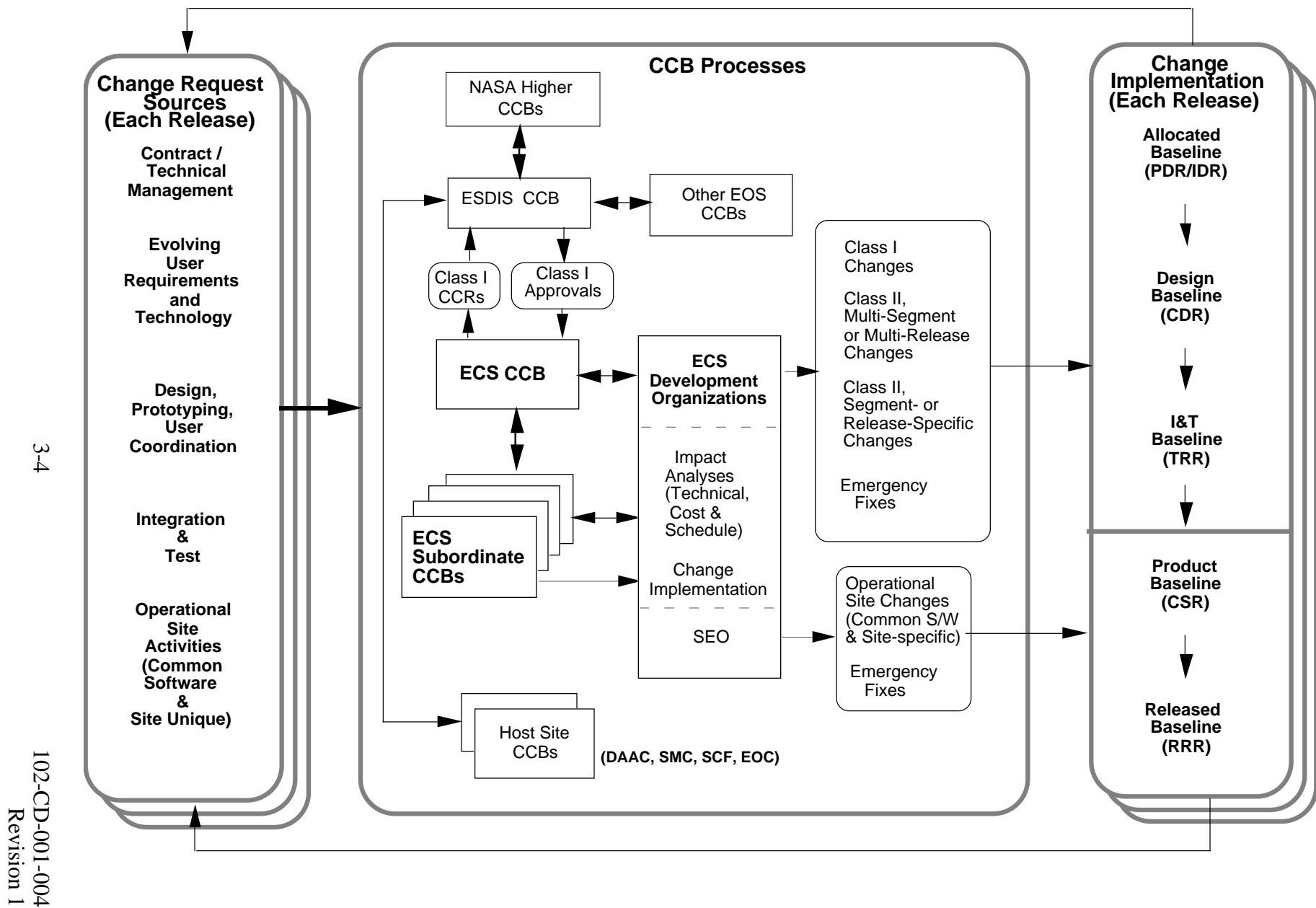
Figure 3-2, ECS Baseline Management, illustrates the process of controlling change as the ECS is developed, integrated, and ultimately deployed to operational sites. After detailed specifications are approved and placed under formal configuration control, candidate changes are reviewed and approved by the responsible CCB before entering the baseline. The change process continues, both to resolve discrepancies and to add improvements, as development proceeds and ECS Releases are delivered to operational sites.

### **3.1.2 Evolutionary, Multi-Track Development and Delivery Mechanisms**

The ECS will evolve and be delivered through the use of multiple development tracks and delivery mechanisms. The development track selected for particular areas of the ECS is a function of the stability of its requirements. Formal development is used for those areas of the system where requirements are believed to be stable and incremental development is used where requirements are less well understood.

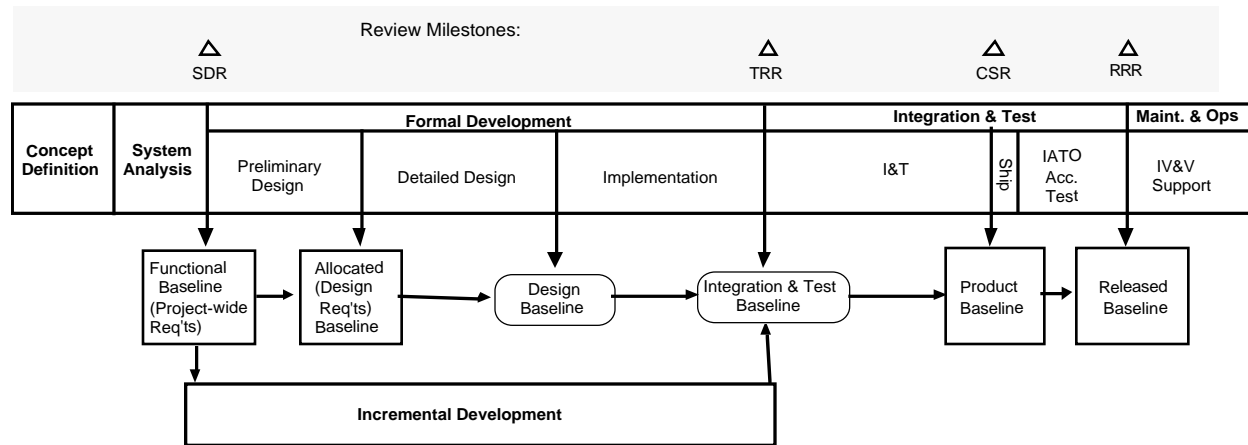
The formal track produces high reliability ECS products through a rigorous process of requirements analysis, design, development to standards, and thorough testing. It is characterized by a complete set of formal documentation (controlled baselines), formal reviews at major milestones in the development cycle, and a single sequence of formal activities and events leading to each formal Release.

The incremental track is a development process distinguished by multiple iterations of requirements, design, and implementation with frequent demonstrations and user evaluations. Each increment is developed with the potential of being integrated into the formal track for a release. Incremental products are first deployed to the user community in Evaluation Packages (EPs) and then revised in ensuing EPs based on evaluation results. Documentation and reviews are streamlined. Formal documentation of requirements and the design is deferred until a user-acceptable design and requirements have been demonstrated. Eventually, products first developed on the incremental track are fielded through the formal track process.



**Figure 3-2. ECS Baseline Management**

Figure 3-3, Formal and Incremental Development Relationships, illustrates the relationships between the two development tracks. Formal and incremental products are developed in their respective development tracks until their Test Readiness Reviews (TRRs). At TRR, the tracks merge and both formal and incremental track products are integrated and tested in Integration and Test (I&T). TRR for incremental products ensures that incremental products have reached a sufficient level of maturity to be merged into the formal track.



**Figure 3-3. Formal and Incremental Development Relationships**

In addition, the development process provides for development of prototypes, toolkits and science software. Prototypes are focused developments of some aspect of the system which may advance evolutionary change. Prototypes may be developed without anticipation of the resulting software being directly included in a formal release. Some prototypes are developed for internal use by their developers and are not delivered. Others may be deployed to the user community for evaluation as "stand-alones" or included in an EP. Unlike incremental products, they are not directly linked to specific software configuration items to be delivered in a formal Release.

Toolkits are important ECS deliveries that are packaged and delivered on a schedule ahead of ECS Releases to facilitate science data processing software development. They are developed by the Science and Communications Development Office (SCDO) and consist principally of developed software with some COTS software. Configuration management of toolkits is generally consistent with CM processes and procedures for formal track development. Toolkits are identified in accordance with naming conventions described in the *Software Development Plan for the ECS Project* (308-CD-001-004). Note, there may be some minor deviations and they are placed under change control. All deployments are controlled by a contractor CCB. Toolkits are delivered to DAACs as common software portable to approved ECS platforms. The toolkits are also used at the SCFs in the development of science software. Problems encountered in toolkits at the DAACs or SCFs are documented on Nonconformance Reports (NCRs) and resolved by SCDO. All controlled versions of toolkits, including those in development and those delivered to DAACs and SCFs, are maintained in the Software Development Library by the Configuration Management Organization (CMO).

## 3.2 ECS Development Project CM Organization

Figure 3-4, CM Organization and Functions, illustrates the CMO's relationships to other ECS organizations. The Configuration Management Organization of the ECS Development Project resides in the Systems Management Office (SMO) which reports directly to the ECS Project Management Office. The SMO also manages the Requirements and Traceability Management (RTM) database tool which is the tool for engineering requirements control, analysis and reporting, and the Nonconformance Reporting (NCR) tool. The RTM database configuration control process is directed by the CMO.

Management of the development CCB system and processes is the responsibility of the CMO. Authority and responsibility for specific change control tasks may be distributed under the management of the ECS CCB and CMO.

The development software library system is administered by the CMO. Authority and responsibility for software management may be distributed to the development organizations until milestones designated by the ECS CCB.

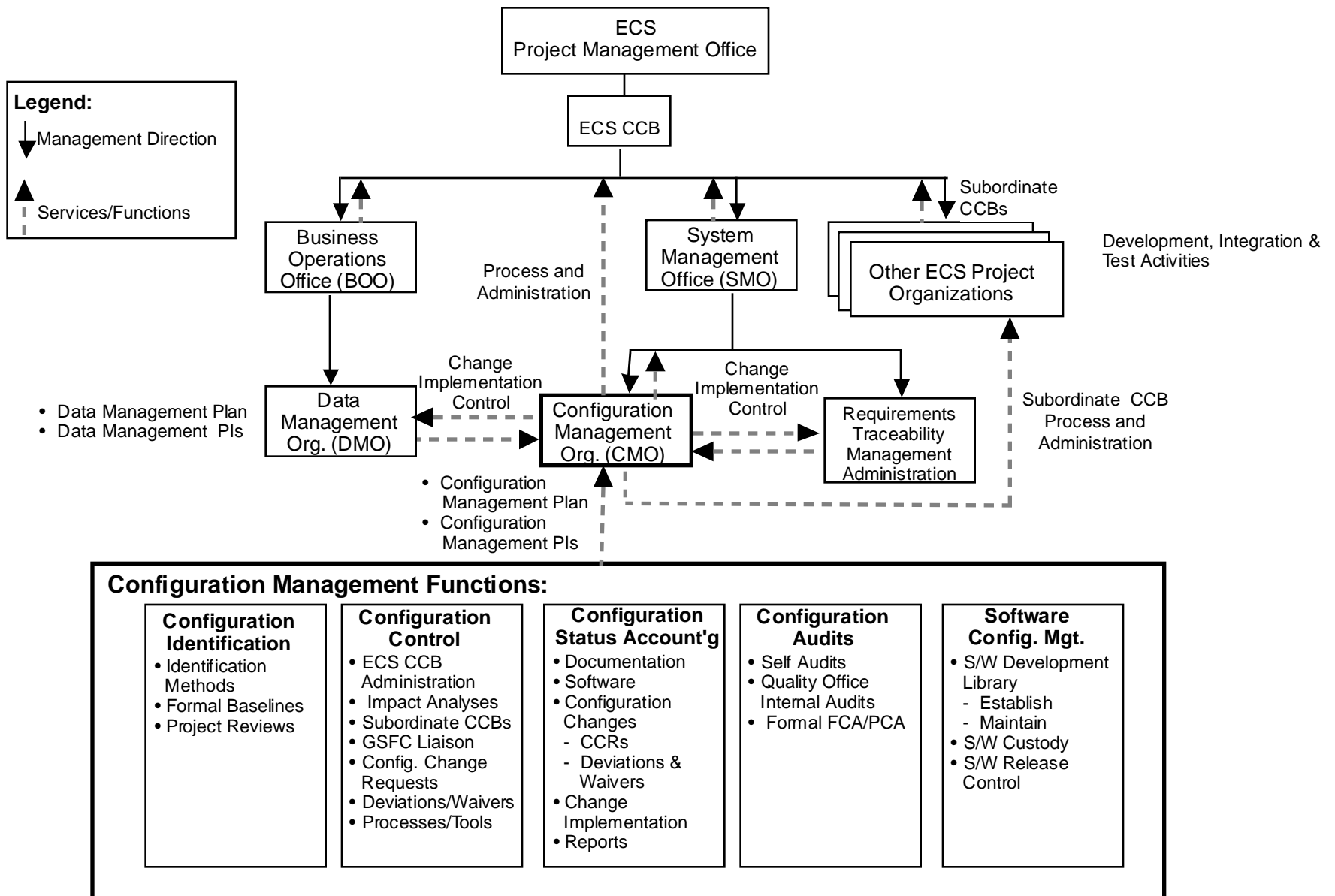
CMO and the Data Management Organization (DMO) share the Configuration/Data Management Tracking System (CDMTS), the tool for change control and status accounting of all ECS documentation. The CMO manages the change control processes in accordance with this Plan. Through the CDMTS, CCB administrations release document change orders for approved CCRs to DMO, which only then update documents and incorporates them into project baselines.

DMO is responsible for managing all ECS documentation and data in accordance with the ECS Data Management Plan and the DM project instructions (PIs). This responsibility includes versioning, maintenance, custody, delivery and archive of all documents controlled by the ECS Project's CCBs. DMO management is a member of the ECS CCB and the ECS CM Working Group.

Responsibility and authority for maintenance and operations configuration management processes rests with the Hughes M&O organization, working in close cooperation with GSFC.

Development-to-Operations CM interface coordination is accomplished through a standing CM Working Group (CMWG). Configuration Management of the operational system delivered at the sites is the responsibility of the Maintenance and Operations Office (M&O). Representatives of M&O sit on the ECS CCB and the CMWG, and review and contribute to CM project instructions. The CMO in turn reviews M&O documentation. Also, developers of the operations CM systems are members of the CM Working Group.

The CMO reviews change requests for compliance with this Plan and the applicable CM PIs and, if found acceptable, forwards them to the CCB for consideration. If the change is approved, CMO coordinates with DMO to ensure that the change is incorporated into the Project baselines and distributed to the document distribution. This coordination allows close communication yet provides a check and balance between CM and DM activities.



**Figure 3-4. ECS Development Project CM Organization and Functions**



The CMO provides a service-oriented organization and standard tools and processes that can be universally applied to implement the CM functions in all ECS development activities. CMO's Project-wide responsibilities include:

- Development and documentation of CM processes and standards.
- Liaison between the ECS Project and ESDIS for CM-related activities.
- Coordination of CM functions to ensure an integrated CM effort within the Project.
- Ensuring that technical documentation and databases, software and hardware generated by the Project are identified, controlled, and accounted for in accordance with this Plan and the applicable PIs.
- Administration of support to the ECS CCB, and direction of subordinate CCB administration.
- Coordination with ECS offices and releases to ensure they are kept informed of CM policies, CCR impact analysis results and rough order of magnitude (ROM) cost estimates, and CCR disposition and implementation status.
- Support to the ECS Quality Office (QO) in the definition, collection, and analysis of CM product and process metrics.
- Definition, acquisition, and maintenance of the CM Tracking System to log, track, and monitor Configuration Change Requests (CCRs) and related items for the Project.
- Definition, acquisition and maintenance of a software tool to manage the software development libraries for the Project.
- Support to Project reviews.
- Support to combined Functional Configuration Audits (FCAs) and Physical Configuration Audits (PCAs).
- Overseeing the dissemination of controlled items among developers and among operational sites.

### **3.3 Development Configuration Management Tools**

This section provides a description of the Configuration Management (CM) tools which support the ECS software development. The CM tools are controlled by the CMO Manager. Proposed changes to CM tools, or their application, are coordinated among the ECS CCB membership before they are implemented.

Additionally, the CM tools support the collection of CM-related metrics. Metrics are a key methodology during project development to assist in determining product readiness and process efficiency. CM metrics will be defined, collected and analyzed in accordance with PI QO-1-014, ECS Project Metrics Process.

An overview describing the functionality and use for each available CM tools is provided.

*Configuration/Data Management Tracking System (CDMTS)* - The CDMTS provides the following functionality:

- Provides CCB agendas and minutes.
- Tracks all change requests, requests from GSFC for ROM Impact Analyses, deviations and waivers to closure.
- Controls implementation of document-change CCRs.
- Tracks document change status, versioning and deliveries.
- Tracks CCB action items to closure.
- Produces status accounting reports on change requests and documents.
- Produces action item reports.

*Requirements and Traceability Management (RTM) Database* - The RTM database system holds all ECS requirements for engineering analysis, and links Configuration Items to requirements. It produces the Configuration Item Lists by Release. The RTM database is managed by the SMO. The database schema and all requirements and configuration item definition in the RTM database are under configuration control. For additional information on the RTM database see PI SE-1-004, RTM Database Standards and Procedures.

*Software Development Library (SDL)* - The SDL is supported and controlled by ClearCase™ an automated software tool. ClearCase™ manages multiple versions of evolving software components, tracks which versions were used in software builds, performs builds of individual programs or entire releases according to user-defined version specifications, and enforces site-specific development policies. This software tool supports the ECS development environment. This same software tool will be deployed to support M&O. Site-requirements and cost-benefit analyses were conducted to determine the tool's application within the M&O environment. For further details on the SDL see PI CM-1-025, Software Development Handbook.

The tool's specific capabilities permit:

- Developers to balance between sharing each other's work and isolating themselves from destabilizing changes. The tool manages the sharing and control of source, object, and executable files.
- Tracking of the software build process so that developers can determine what was built and how it was built. The tool also can instantly recreate the source base from which a software system was built, allowing it to be rebuilt, debugged, and updated without interfering with other programming work.
- Project administrators to define development policies and procedures, and automate their enforcement.
- Tracking of documentation as well as source elements. The tool supports the creation of new element types and the assigning of user-defined attributes to these types. Not only does this provide for recording of configuration items, with attributes, but also a chronological change history for each configuration item.

*Vendor Costing And Tracking System (VCATS)* - Vendor maintainability data is collected as part of the procurement process. This data is first recorded in the Integrated Logistic System (ILS) database called VCATS. This data is then used as the basis for the maintainability predictions for each release. The VCATS data base contains the detailed COTS hardware and software configurations of all Project computers in the Software Development Environments. The VCATS data base also includes records of the non-privileged software on each computer. For more details on the VCATS data base see PI SE-1-002, ECS Development Facility (EDF) Configuration Control.

*DDTS™ (Distributed Defect Tracking Software)* - The ECS software Nonconformance Reporting and Corrective Action (NRCA) system utilizes the DDTSTM software tool by Pure Software to record nonconformances. DDTSTM has been customized by ECS to accurately reflect the process for resolution of Nonconformance Reports (NCRS) by the NRCA system (see PI SD-1-014, Nonconformance Reporting). Through the production of management reports, DDTSTM provides management visibility and metrics to insure that NCRs are being worked in a timely and effective manner.

## 4. Development Configuration Management Activities

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This section provides details on the ECS Project's CM policies and processes.

### 4.1 Configuration Identification

Configuration identification is the process of identifying and documenting the functional and physical requirements of a system. It takes the form of controlled technical data bases and documentation that identify and describe the system and its component parts during its life cycle. The ECS technical documentation includes requirement specifications, interface requirement documents, design specifications, interface control documents, detailed Configuration Item (CI) design specifications and drawings.

Configuration identification includes the establishment of baselines; assignment of identifiers; preparation, maintenance and cataloging of all documentation and as-built records; and establishment of a hierarchical configuration items list (CIL). The CMO ensures that there are unique identifications for each configured or controlled item or document and for associated configuration change documentation. The current configuration of ECS CIs can be reported and prior configuration and development and test environment identifications can be reconstructed.

ECS Configuration Identification will be updated regularly to document how current and historical configurations are identified.

#### 4.1.1 Baselines

There are six major baseline categories for the ECS, but the actual number of baselines is magnified because of the Incremental Release Plan for the Project. Intermediate baselines may also be identified to support, for example, integration and test activities.

The ECS CCB is responsible for baseline identifications. All documentation comprising a baseline is subject to formal configuration control. CCRs identifying baselines are identified as such and the baseline is identified in CDMTS. Formal configuration identification, status accounting and verification also apply.

<u>Baseline</u>	<u>Milestone</u>	<u>Notes</u>
<u>Requirements</u>	<u>SRR</u>	
System Functional	SDR	The system functional baseline is incrementally updated after each Release Initiation Review (RIR). It includes Functional & Performance Requirements Specification, Interface Requirements Documents (both controlled by ESDIS) and other system-level design and management documents.
Allocated	PDR, IDR	The initial allocated baseline is set after PDR, but incremental release allocated baselines will be identified after each IDR. The current allocated baseline is the basis for detailed design for each release. It includes segment requirements and design documents, database specifications and interface control documents. Multiple allocated baselines may coexist.
Design	CDR	A new design baseline will be set after each CDR. Multiple design baselines may coexist.
Product	CSR	This identifies the "as-built" configuration after successful completion of system integration testing for independent acceptance testing
Operational	RRR	A new incremental operational baseline is set after the RRR for each release.

#### **4.1.2 Requirements**

All ECS project requirements specifications are maintained under configuration control in the RTM database. This controlled database serves as the source for all ECS requirements documents, engineering change analysis and change proposals. The RTM database holds requirements of all levels. It provides traceability of parent-child requirement relationships and allocations of requirements to releases and it links requirement changes to change notices,

#### **4.1.3 Documentation**

The configuration identification of each ECS product is defined by a hierarchical set of formal documents, drawings, or listings that define the product within the framework of form, fit, and function. The documentation set is the authorization for the existence of every ECS product.

Formal documentation includes requirements specifications, interface requirements documents, design specifications, interface control documents, detailed design specifications, and other supporting programmatic and technical documentation. DMO has custody of all ECS documentation and is responsible for assigning document numbers as required by the GSFC Technical Information Program (TIP) and as described in PI DM-1-002, Documentation Numbering. DMO maintains the identification (current and historical) of controlled documents.

ECS software products delivered for evaluation in the incremental track are identified by development notebooks that may contain white papers, briefing charts, or annotated charts. CMO and DMO are responsible for defining numbering schemes and templates for notebooks to ensure a uniform approach by the ECS development organizations. The informal notebooks enable flexibility and quick action, yet they have sufficient structure and discipline to ensure that

documentation for products evolving to the formal track captures the actual requirements and design from the incremental track. Technical details from the incremental track notebooks migrate into the "as-built" documentation for CSR and provide the basis for development of M&O materials for RRR.

Software Development Files (SDFs) used by the developers during in-process software coding and testing are described in the next paragraph.

#### **4.1.4 Developed Software**

ECS developed and maintained software is managed by CMO in the Software Development Library (SDL). The configuration identification of software is established by its documentation set and by a unique naming convention described in the *Software Development Plan for the ECS Project* (308-CD-001-004).

SDFs are maintained by the responsible engineer and programmer during each software component's coding and testing. An SDF is an evolving entity that contains historical information that represents the current state of the software component. It provides the responsible engineer with a readily available hard copy or electronic reference to significant aspects of the developing software and gives management a view into software progress and status. An SDF is established for each software component upon approval of the architecture (following PDR), and is thereafter a working file maintained to document the evolving design and development effort. SDFs remain informal and in the control and custody of the developers. The software represented by SDFs is formally identified and controlled by its formal design specifications. Additional details on SDFs can be found in the *Software Development Plan for the ECS Project* (308-CD-001-004) and PI DM-1-004.

The CMO is responsible for providing a file structure in the SDL for the incremental track products. Those files remain under the control and custody of the development organizations until the incremental track products are ready for integration into the formal track. After approval to integrate incremental products into the formal track, incremental track products become part of the formal ECS baseline and subject to all of the configuration control practices of the formal track.

#### **4.1.5 COTS Software**

All COTS software products are formally identified. COTS product requirements in the ECS are documented in approved specifications by the responsible development organization. Deliveries from COTS vendors are accompanied by detailed specifications and complete historical change data. COTS software modified by the vendor is delivered with addendum documentation describing the changes from the off-the-shelf product. COTS software modified by ECS development organizations is also documented by addendum documentation as necessary to define the changes from the off-the-shelf product. Configuration files developed for COTS software are treated as developed code and are maintained and controlled in the SDL.

#### **4.1.6 COTS Hardware**

The ECS Project has no developed hardware. The configuration identification of COTS hardware is defined by its governing documentation similar to ECS developed software CIs. CMO ensures the identification of COTS products by vendor names, part numbers, version/revision numbers, serial numbers, installed locations, and installation parameters such as installation and removal dates.

#### **4.1.7 Data Bases**

Data bases are applicable only to the formal track and are defined by both their schema and their contents. Data base schema are treated as software, identified as part of the ECS baseline, and controlled by the applicable CCB. Data base contents can be categorized either as static parameters used by the system during its operation or as dynamic data generated by the system during its operation.

### **4.2 Configuration Change Control**

The objective of ECS configuration change control is to ensure changes are adequately defined, assessed for technical, cost, and schedule impacts by all ECS Project segments and offices, and formally considered by a Project Configuration Change Board (CCB). In addition, change control ensures that only approved changes are incorporated in the appropriate baseline in an orderly and systematic manner.

The following paragraphs describe the configuration change control responsibilities and activities to be used in controlling, maintaining, and implementing changes to ECS baselined products.

#### **4.2.1 Change Processes**

Change control processes are developed and administered by the CMO. The following PIs document details of the process:

CM-1-003, -004, -006, -007, -013, -024

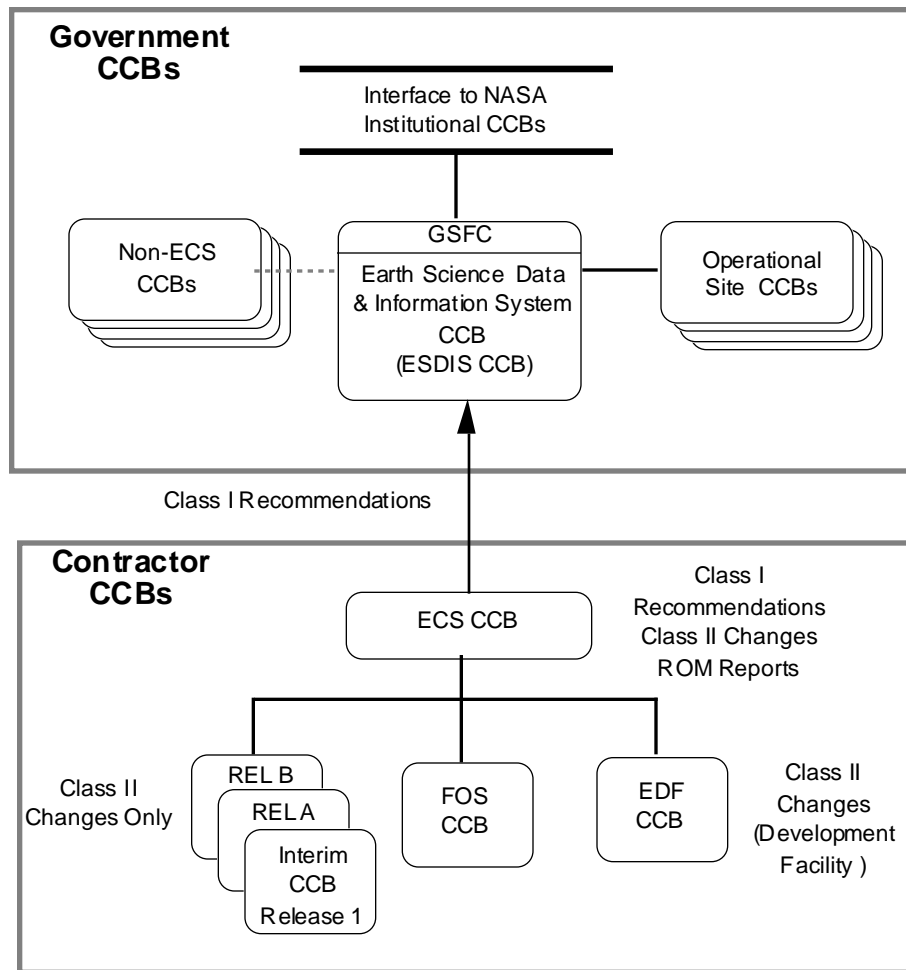
#### **4.2.2 Change Control Board (CCB) Administration**

CCB administration is distributed. Definition and management of change control processes for all CCBs are the responsibility of the ECS CMO. The CMO also provides tools, training and verification to implement the processes for all CCBs. Administration and status accounting for the ECS board are provided by CMO, while for the subordinate CCBs these services are provided by their own organizations under direction of CMO.

Each CCB administration maintains a standard membership and distribution list. Agendas and proposed changes are forwarded to the distribution list in advance of meetings. Minutes and action items are recorded and open action items are tracked to closure.

#### **4.2.3 Change Control Boards**

Figure 4-1, ECS Configuration Change Boards, illustrates the ESDIS CCB at the highest level, followed by the Hughes ECS CCB, then the currently constituted lower level boards for the Flight Operations Segment, three Release organizations and the ECS Development Facility. The ECS CCB charters and allocates responsibilities to the subordinate boards.



**Figure 4-1. Current ECS Configuration Control Boards**

The CCBs are responsible for reviewing and dispositioning candidate changes to the ECS baseline, responses to formal GSFC information requests, control of RTM database (the requirements engineering tool), authorization of milestone turnovers, nonconformance management, and Class II changes appropriate and necessary for design and product integrity.

It is the members' responsibility to ensure that all internal and external impacts are identified and addressed. The organization sponsoring a change request is responsible for addressing technical, cost and schedule issues before the meeting and for completing actions assigned by the CCB chairman, providing rough-order-of-magnitude estimates (ROMs), and attending GSFC technical review and CCB meetings as requested. Government representatives may attend ECS CCB meetings at their option to verify process or exchange information.

The following paragraphs describe the ESDIS and Project-level CCBs, and their responsibilities and memberships. Note that membership may change from time to time to remain congruent with the project organization.



#### 4.2.3.1 ECS CCB

The ECS CCB is the sole formal change management interface to the ESDIS CCB and reserves to itself the authority to recommend Class I changes to the ESDIS CCB. The ECS CCB has the authority to full approve and implement Class II changes to the ECS development baseline. It controls system-level documents and cross-segment or cross-release documents except for those designated by GSFC for ESDIS CCB control. The ECS CCB may delegate control of segment-level requirements and design specifications to subordinate CCBs. Technical records 151-TR-001 and 152-TR-001 are maintained by the ECS CCB to record allocation of change control authority.

The ECS CCB meets on a regular schedule and for ad hoc or emergency meetings as required. The ECS CCB is chaired by the project manager's designee and is composed of the following representatives.

Chairman	Designated by Project Manager
Representatives from	System Management Office (SMO) All Release Organizations Test and Acceptance Organization (TAO) Science and Communications Development Office (SCDO) Flight Operations Segment (FOS) Quality Office (QO) Maintenance and Operations (M&O) Business Operations Office (BOO) Contracts Office Subcontracts Management Organization (SCM)
CCB Administrator	CMO
Ad hoc members	As needed

#### 4.2.3.2 Segment and Release Organization CCBs

The ECS CCB charts subordinate development CCBs as consistent with the ECS subsystem-development organizations. Both Segment and Release CCBs may exist concurrently if appropriate (for example, FOS, Release A and Release B). The ECS CCB delegates Class II change authority for specified documents, handoffs and releases to these subordinate boards (see 151-TR-001 and 152-TR-001). It reserves to itself Class II actions that cut across the provinces of subordinate boards.

With the ECS CCB's consent, a Segment or Release Organization Board may establish a subordinate review board with specific authority, for example, NCR management. Such review boards will be administered to the same standards for recording attendance, decisions and action items as the CCBs themselves.

Each Segment or Release CCB is chaired by its Organization's Manager. Its membership is composed of the following contractor representatives:

Chairman	Cognizant Organization Manager
Representatives from	Cognizant Organization's Development Groups Other Release or Segment Organizations Cognizant Organization's I&T Group Independent Acceptance Test Organization (IATO) System Management Office (SMO) Quality Office (QO) Maintenance and Operations Office (M&O)
CCB Administrative Support	Cognizant Organization
CMO Interface	Configuration Management Organization (CMO)
Ad hoc members	As needed

#### **4.2.3.3 ECS Development Facility CCB**

The ECS EDF CCB has the responsibility for controlling the ECS development environment. It meets on a regular schedule to control Class II changes to COTS and developed data, hardware, software, networks, facilities, and procedures which comprise the EDF configuration baseline. The EDF CCB oversees implementation of EDF changes. The EDF configuration supports ECS product development at both the segment and system levels. Class I changes (e.g., impacting ECS costs, budgets, or products) and project procurements are assigned to the ECS CCB.

The EDF CCB meets as necessary to resolve EDF issues which could adversely affect segment or system schedules and costs. It also initiates interim fixes to immediately resolve emergency problems as directed by the EDF manager. Matters requiring emergency response include health and safety issues, disaster response, calls to emergency response teams (fire, police, etc.), matters requiring system emergency shut-down or maintenance, or exercise of pre-approved contingency plans. Additional details on the EDF change control and the CCB can be found in PIs SE-1-002, ECS Development Facility (EDF) Configuration Control, and CM-1-007, ECS Development Facility (EDF) Change Control Process.

The EDF CCB is chaired by the M&O Office. The membership is composed of the following contractor representatives:

Chairman	Manager - EDF
Technical Assistant	Omnibus Representative (M&O)
Representatives:	Facility Manager
	EDF Support Manager
	Integrated Logistics Support (ILS) - M&O
	Subcontracts Management Organization (SCM)
	System Management Office (SMO)
	Test and Acceptance Organization (TAO)
	Flight Operations Segment (FOS)
	Science and Communications Development Office (SCDO)
	Quality Office (QO)
CMO Interface	Configuration Management Organization (CMO)
Administrative Support	M&O
Other technical support	As invited

#### 4.2.4 Change Classes

Class I and Class II changes are defined in the *Earth Observing System (EOS) Configuration Management Plan* (420-02-02) and in the current draft of the *ESDIS Configuration Management Plan*, and are determined by the technical or contractual content of the change.

A Class I change is an out-of-contract scope change that affects the form, fit, or function of the ESDIS Project CCB controlled items in one or more of the following ways:

- The technical baselines, including Functional, Allocated, or Product baselines; to include the System Specification
- The Product Configuration Identification (PCI) as contractually specified.
- Technical requirements contained in the PCI, including the following:
  - Performance outside stated tolerance
  - Reliability, maintainability, or survivability outside stated tolerance
  - Weight, balance, and moment of inertia
  - Interface characteristics
  - Interchangeability
- Non-technical contractual provisions:
  - Contract cost and fee
  - Schedules
  - Deliverables

- Other factors:
  - Government-furnished equipment (GFE)
  - Safety
  - Electromagnetic characteristics
  - Operational, test, or maintenance computer programs
  - Compatibility with support equipment and training devices/equipment
  - Configuration to the extent that retrofit action would be taken

A Class II change is an in-scope contract change that does not fall within the definition of a Class I change. Examples of Class II change are:

- A change in documentation only (e.g., correction of errors, additions to clarify notes or views)
- A change in hardware materials (e.g., substitution of a part or alternative material).
- A change in software code prior to product delivery (e.g., to comply with design and performance requirements)

#### **4.2.5 Change Requests**

There are no undocumented changes to ECS products scheduled for delivery from the formal track. Changes are implemented only after completion and approval of a change request generated against the product's technical documentation. Assignment of changes to a Release is the responsibility of the ECS CCB and is a function of when the change is needed in the schedule by the development, test or M&O organization, versus the availability of resources to implement the change.

All change requests are submitted to the appropriate CCB administrator using the CCR Form and an attached change definition package defining the proposed changes to the applicable drawings or specifications. The Project organization originating the change request is responsible for providing the information required on the CCR Form and for defining the proposed changes to affected documentation.

Preparation of CCRs is described in PI CM-1-003. CCB processes are described in PIs CM-1-004, -007, and -024. CCRs are distributed by the CCB administrator and reviewed for technical, cost, and schedule impact on a scheduled basis by the appropriate CCB. Special CCB meetings are scheduled as required to consider urgent or emergency change requests. All CCRs to be considered by the CCB are distributed to the appropriate Project organizations by CCB administration for review and impact assessment before the CCB meeting. Impacts, including those from subcontractors, are reviewed at the CCB meeting and the request for change is dispositioned by the Chairman. The CCB Chairman has final approval/disapproval authority. For Class II changes, the CCB Chairman's approval constitutes authorization to implement the change.

The ECS CCB has sole authority for approval and submittal of Class I changes and ROM Reports to the ESDIS CCB. Upon approval by the ECS CCB, a CCR is forwarded to the ESDIS CCB as a recommendation. Approval by the ESDIS CCB does not constitute authorization for the contractor to implement changes. The contractor must receive contractual direction to implement any Class I changes. A ROM Report may be required by the customer. Figure 4-2, ECS Change Process, illustrates the relationships between the ECS CCB, the ECS CMO, the Project Offices and Release Organizations and ESDIS. Details on the Project's procedures for providing analyses and information to ESDIS can be found in PI CM-1-013, Government Requests for Impact Analysis.

The Project's Subcontracts Management Organization (SCM) is responsible for coordinating and managing the subcontractors' participation in the change process. Individual representatives of the Project's various subcontractors may be assigned as CCB representatives. SCM reviews all proposed CCRs. Once contractual change direction has been received, SCM is responsible for negotiations with subcontractors and for making the appropriate changes to subcontracts. Detailed procedures for processing changes with subcontractors are included in PI SM-1-003, Change Administration processing - Subcontractors.

#### **4.2.6 Nonconformance Reports**

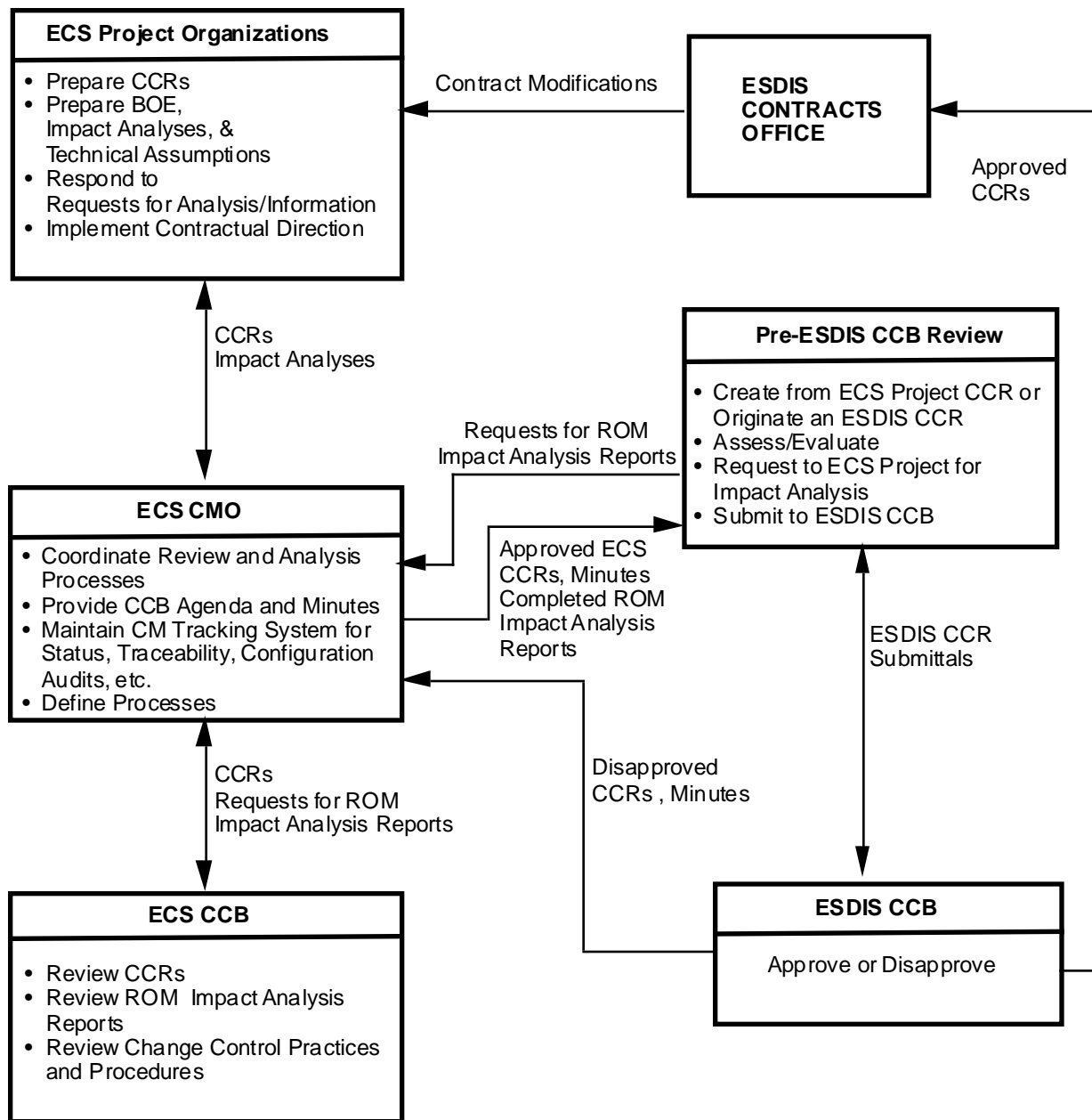
Nonconformances in Project hardware and software products in development and operations are recorded and tracked via Nonconformance Reports (NCRs). NCRs are submitted against any configuration item found not to be in accordance with its governing technical documentation.

NCRs for a given configuration item are evaluated and scheduled by a designated review board for disposition.

The Project provides an automated tracking system to initiate, prioritize and track NCRs. The development phase nonconformance reporting and corrective action process is documented in PI SD-1-014. Additional details on problem reporting are included in the *Performance Assurance Implementation Plan for the ECS Project* (194-501-PA1-001) and in the *Description of Contractor and Subcontractor Audit Programs for the ECS Project* (194-505-PA3-001).

#### **4.2.7 Software Change Implementation**

Typically, a number of software fixes and CCB-approved changes are processed together in the EDF in the same software upgrade package (new release or version). Under ESDIS direction the ECS has sole responsibility for all changes incorporated in ECS products. Prior to the acceptance of software upgrades, the preparer submits a software turnover package for review by the appropriate CCB. The turnover package describes the NCRs and CCRs included in the upgrade, special instructions about building or installing the software, and updates to affected documents. The software is moved into a CMO-controlled environment (the SDL) upon approval of the turnover package. PI CM-1-025, Software Development Handbook, provides details on the software turnover process.



**Figure 4-2. ECS Class I Change Process**

Emergency fixes may be installed in controlled software with the responsible CCB's (or designated representative's) approval, but separate from a formally released software upgrade. Emergency fixes are installed only in cases when waiting for a formally released change would significantly impact the ECS Project's costs, schedules, or operational capabilities. In all cases, installation of emergency fixes (and other changes) is coordinated with on-going Project activities such as system acceptance in order to ensure that the Project activities are not adversely affected. Emergency fixes are transmitted with their documentation to the applicable engineering or maintenance organization where they are evaluated and included in a formal software upgrade (or formal Release), either as originally installed, or as modified by the responsible engineering or maintenance organization.

Software maintenance activities begin on operational software following Release Readiness Review (RRR) for each release. The configuration management process is a part of software maintenance. For additional information refer to the *Maintenance and Operations Configuration Management Plan for the ECS Project* (102-CD-002-001).

#### **4.2.8 Configuration Change Documentation**

The following paragraphs summarize the principal CM-related forms and documents that are used in the ECS CM process. Forms and other process documentation are revised whenever needed to support continuous process improvement.

##### **4.2.8.1 Configuration Change Request**

All requests for change are documented using a CCR Form. A CCR is generated against the data base, document/drawing or software/hardware product affected by the proposed change. CCRs are submitted to the appropriate CCB for consideration as described in this plan. CCRs, and instructions for their preparation, are described in PI CM-1-003, Configuration Change Requests.

The CCR Form is also designed to be used for deviations and waivers as described in the applicable paragraphs in this section.

##### **4.2.8.2 Request for Deviation or Waiver**

Requests for deviations or waivers are initiated using the CCR form as a cover sheet for the deviation or waiver form. These requests are reviewed by the ECS CCB and submitted to the ESDIS CCB for approval. Instructions for preparation of deviations and waivers are described in PI CM-1-006, Deviations and Waivers.

##### **4.2.8.3 Document Change Notices and Histories**

All CCB-approved changes and revisions to configuration controlled documentation are implemented by a Document Change Notice (DCN). As DCNs are incorporated into documents a history log is updated in the front of the document to define the current configuration of the document in accordance with NASA Specification 500-TIP-2110. DCNs are issued via a transmittal memo. Details for preparation and submittal of DCNs are included in PI DM-1-004, CDRL and Required Documentation Generation, Review, Release, and Maintenance.

## **4.2.9 Controlled Storage and Release Management**

The following paragraphs describe the controlled storage and release management for developed software, COTS software, and data bases.

### **4.2.9.1 Developed Software**

The SDL located in the EDF is the key to ECS software release management. It is the central repository for ECS software, and provides a structure of controlled software files for ECS development and operations.

The SDL is a hierarchical library structure which provides capabilities for simultaneously managing different versions and releases of ECS software. When developing a new version, components being changed are checked out from the SDL and modified as necessary. New components, if required, are added to the new version in its SDL level. The process continues for any number of versions. Each SDL level for a new version contains only those components which are changes from the previous version or are new additions to the version. When building a complete release or system for any version, the automated software tool searches each component's version tree for the desired version.

The SDL's branches/structure are configured by CMO prior to starting software development. Figure 4-3, Software Development Environment, illustrates the SDL and its relationships to ECS development, test, integration, acceptance, and Independent Verification and Validation (IV&V) files. A structure of software files is established for use by individual programmers and their Team Leaders during unit-level software development. Access to separate files is controlled via passwords and designated read/write privileges. To access a software component for initial coding or for modifications, programmers "check out" the component. Procedures exist via the SDL's branching and merging capabilities to allow multiple developers to modify the same component.

Control migrates to higher levels as the system develops and matures. Figure 4-4, Software Control and Custody, illustrates the responsibilities for configuration change control, software custody, and problem resolution during the product life-cycle as software evolves from the individual programmer level to a released system at operational sites.

Software in the incremental track is informally controlled by the responsible development organization until it is approved to be integrated into the formal track. On-going changes are necessary in the incremental track to refine the requirements and the design as the developers interact with users evaluating the EPs. Leaving control with the developers improves response time in the incremental track's evolutionary environment. Requirements and design changes are managed by the applicable Segment CCB.

Developed software (external to ECS) received from subcontractors is evaluated by the applicable ECS development organization to ensure conformance to contractual and functional requirements. Once accepted by the development organization, it is turned over to the CMO and installed in the SDL; and related documentation is forwarded to DMO for storage in the DMO library. Any changes or enhancements required are implemented by SMO via formal contract changes. Software upgrades delivered by ECS subcontractors are handled in the same manner as the original deliveries.

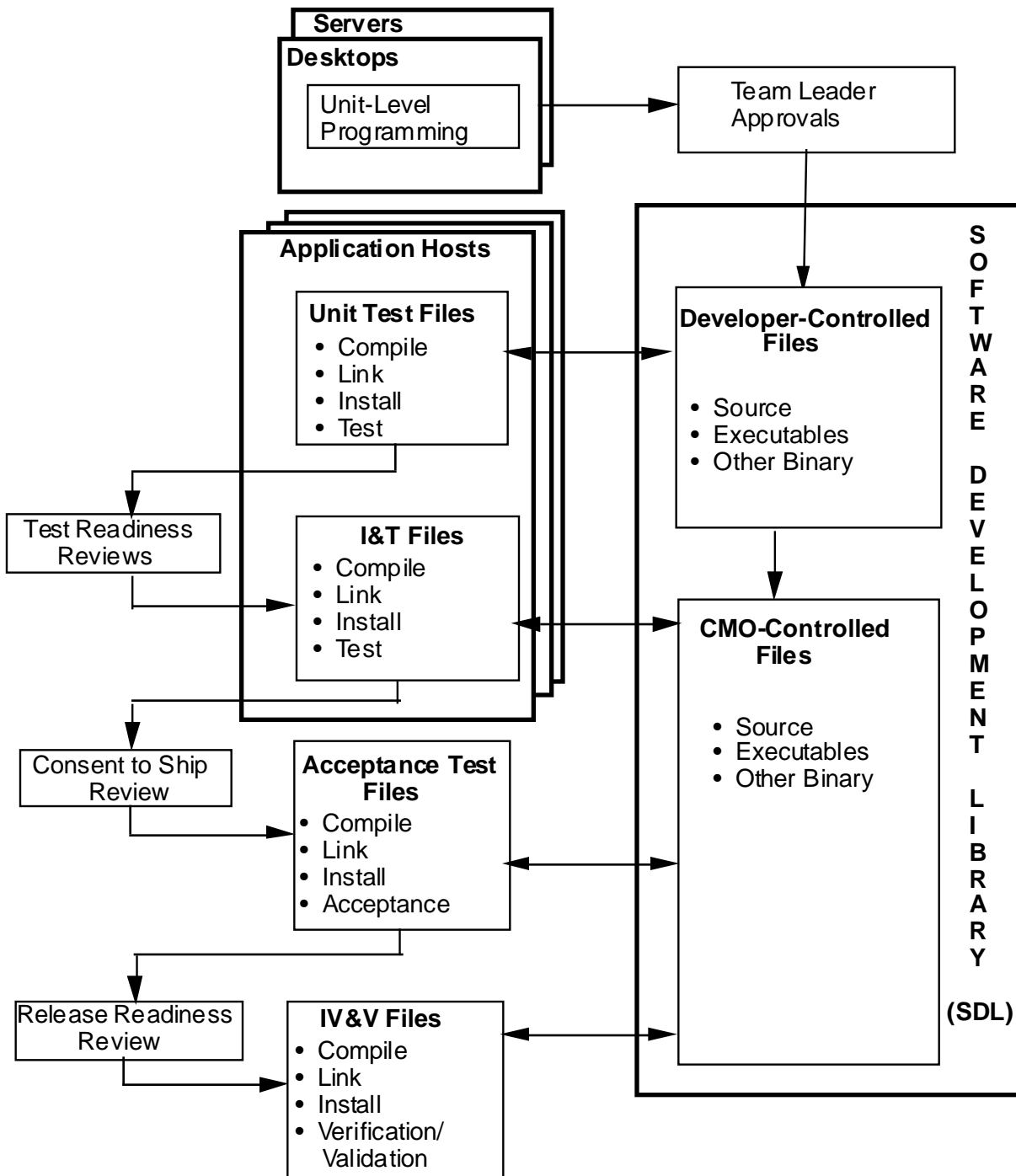


CMO takes formal custody of software at the TRR, which is composed of a number of separate reviews. The primary TRR takes place when the first thread is delivered from development to I&T. The purpose of the primary TRR is to verify thread delivery against standards for delivery, form, and content using the first thread as a model. When the first thread is approved, CMO takes custody of this and succeeding threads. An incremental TRR is conducted for each succeeding thread. When the last thread is delivered, a final TRR is conducted to review all threads and to close the TRR for that Release. TRR is complete when all threads meet standards established at the primary TRR and CMO takes custody of the final delivery. Upon receipt of software turned over by the development organization, the CMO compiles and links the software to ensure that the turnover is complete and the turnover integrates within the CM-controlled environment. Upon completion of the build, the software is installed in the assigned location in the SDL. For more information see PI CM-1-025, Software Development Handbook.

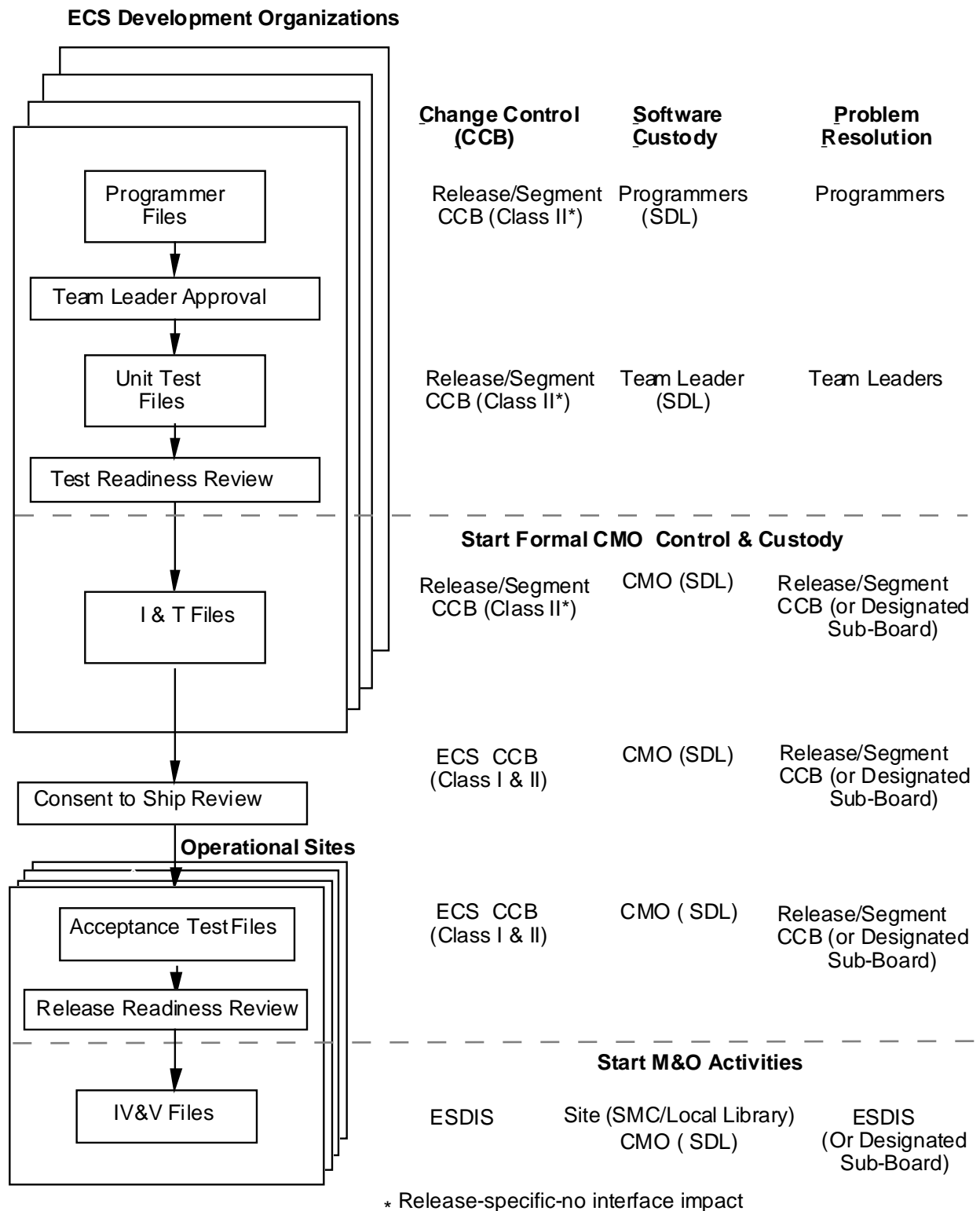
All CCB-approved changes to software in CMO's custody are installed by the CMO. The currently approved version of software in the SDL is made available by the CMO to the test team for I&T. Following completion of the I&T (thread tests) the software is made available by CMO to the I&T team. During the I&T phase, deliveries continue to be promoted in the SDL until the delivery of the final thread. At this point, the final test release is complete.

Following the successful completion of I&T the SEO is given 30 days for conducting Pre-CSR testing. Pre-CSR testing ensures that the software meets requirements, operates properly, is ready for integration into the ECS configuration, and that test documentation is complete. For additional information on Pre-CSR testing see the Software Development Handbook (PI CM-1-025) and the Software Development Handbook Quick Reference Guide (151-TP-001-001).

Completion of the CSR and ESDIS' approval authorizes CMO to release software to the host sites. The released software is left on-line in the SDL to define the delivered configuration. Local libraries are maintained at the operational sites by the Independent Acceptance Test Organization (IATO). CMO continues to maintain the currently approved software version in the SDL while the IATO conducts the acceptance tests. Approval of the RRR authorizes the CMO to deliver the Released Baseline to the SEO.

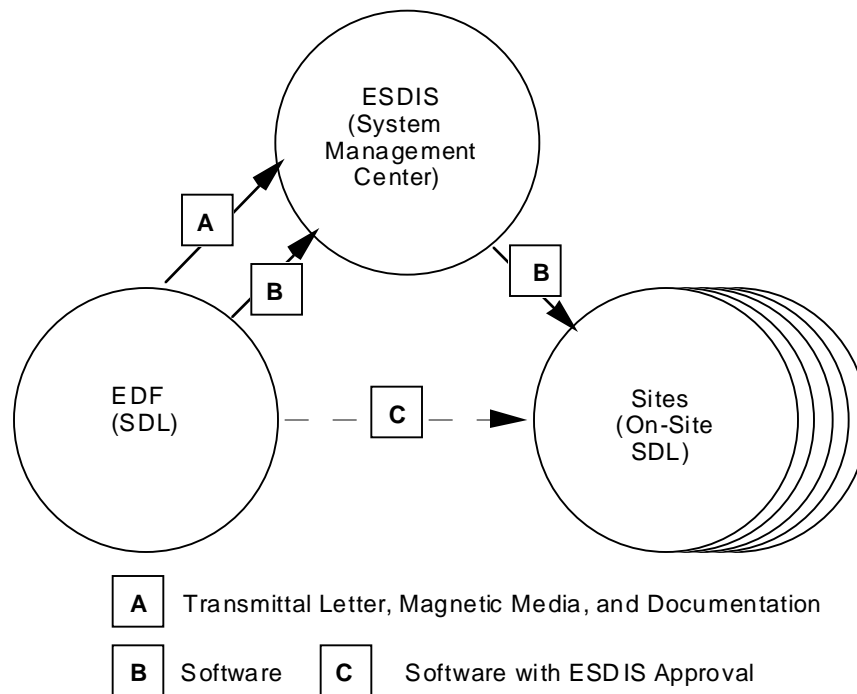


**Figure 4-3. Software Development Environment**



**Figure 4-4. Software Control and Custody**

Figure 4-5 illustrates the software release process. Software releases are accomplished by the Release Manager or responsible CCB completing a letter of transmittal. CMO assembles and packages the delivery in accordance with the instructions in the transmittal letter. The transmittal letter, magnetic media, and documentation are delivered to ESDIS. In parallel, electronic transfers of software take place between the EDF SDL and ESDIS systems management center for retransmission to DAACs or SCFs. With ESDIS permission, EDF may transmit directly to the recipient. In the event an electronic transfer is not possible, the delivery is made by magnetic media.



**Figure 4-5. Software Release Process**

#### 4.2.9.2 COTS Software

All COTS software is formally controlled. The controlled storage and release approach for COTS products is a function of whether they are unmodified or modified:

- *Unmodified COTS.* Unmodified COTS is delivered with the vendor's standard documentation package. COTS upgrades initiated by the vendor are reviewed for acceptability by the responsible CCB before they are implemented. Magnetic media and licenses for unmodified COTS are physically stored by CMO in the computer program library. Unmodified COTS is released by CMO to users in accordance with the provisions of the licensing agreement.

- *Vendor-Modified COTS.* In some cases, the COTS vendor is contracted to incorporate changes into COTS in accordance with Project specifications. Magnetic media and licenses for COTS software modified by the vendor are physically stored by CMO in the computer program library. Vendor-modified COTS is released by CMO to users in accordance with the provisions of the licensing agreement.
- *ECS Project-Modified COTS.* In some cases, the ECS Project will secure the license to modify COTS and obtain rights to the source code to permit the responsible development organization to modify the COTS software. Project-modified COTS software is maintained in the SDL, and magnetic media and licenses are physically stored by CMO in the computer program library. Project-modified COTS is released by CMO to users in accordance with the provisions of the licensing agreement.

COTS products are included as parts of the ECS I&T process, and problems associated with COTS are recorded, dispositioned, and corrected with vendor assistance as required.

#### **4.2.9.3 Data Bases**

Contents of static data files pertaining to the system or release(s) are controlled by the ECS CCB or the responsible Release or Segment CCB(s), as appropriate. The contents of site-specific static data files are controlled by the applicable site CCB. The contents of dynamic data files are not controlled.

#### **4.2.10 Configuration Management at Operational Sites**

ECS products deployed to the operational sites include software which is common to various operational sites and software which is site-specific. Both common and site-specific software that has been released for operational use is maintained in the M&O software library and maintained at each site (On-Site SDL). Site personnel maintain independent libraries for science software and other software not developed by ECS. Site personnel are responsible for any CM activities concerned with this library. See the *Maintenance and Operations Configuration Management Plan for the ECS Project* (102-CD-002-001) for details on how the SDL is maintained at each site.

### **4.3 Configuration Status Accounting**

Configuration status accounting consists of recording and reporting information about the configuration status of the ECS Project's documentation, hardware, and software products, throughout the Project life cycle. Periodic and ad hoc reports keep ECS Project management and ESDIS informed of configuration status as the Project evolves. Reports to support reviews and audits will be extracted as needed. CMO maintains CM pages and also contributes to the Requirements pages in the on-line ECS Technical Management Data Base which is accessed through the ECS Data Handling System (EDHS).

The automated software tool automatically records and tracks as-built and historical versions of ECS software; and provides status accounting reports as necessary. All software changes are documented. Software changes that do not involve requirement changes are documented by nonconformance reports. When software changes result from requirement changes, they are documented by approved CCRs.

DMO maintains status accounting information in CDMTS for each ECS document controlled by Project CCBs. CDMTS records and reports document change status and histories, milestone baselines, and change status. CMO maintains configuration change status accounting information in CDMTS for each configuration change document (CCR, Waiver/Deviation) originated within the ECS Project and also maintains the CCR class in the RTM database. Historical records are maintained on each CI to provide a traceable path to previous configurations.

There is no formal status accounting of ECS products in the incremental track. Each development organization is responsible for any status accounting required of their incremental track products. Products from the incremental track which are integrated into the formal track are subject to the formal track status accounting practices.

PIs CM-1-008 (Configuration Status Accounting and Reporting), CM-1-026 (Change Control Accounting in CDMTS), and SE-1-004 (RTM Database Standards and Procedures) provide additional details on configuration status accounting.

## **4.4 Configuration Audits**

Configuration auditing is the means by which management ensures that both the technical and administrative integrity of the product are being met throughout the Project development life cycle. The audit process consists of CM self-audits, ECS Project internal audits, and formal audits conducted by ESDIS. Formal audits are a prerequisite to formal approval of the "as-shipped" configuration. They provide verification that each CI in the baseline being shipped is logically related to the corresponding CI in preceding baselines, and validate that the baseline meets requirements. ECS products in the incremental track are not subject to configuration audits.

Internal CM self-audits are conducted by CMO. Self-audits evaluate the Project's compliance with the EOS Configuration Management Plan and this Plan. The CM self-audits verify:

- That CM policies, procedures, and practices are being followed.
- That approved changes to documentation and hardware products are properly implemented.
- That the as-built documentation of each CI agrees with the as-designed configuration or that adequate records of differences are available at all times.

A post-audit report is written outlining the specific items audited, audit findings, and corrective actions to be taken. All action items are tracked to closure.

The CMO supports internal audits scheduled and conducted by the ECS Quality Office (QO). Internal audits conducted by QO evaluate similar items as the self-audits and, in addition, review test results to verify that ECS products meet their specified performance and design requirements to the extent determinable by testing. CMO takes corrective action as necessary in areas found to be non-compliant with governing documentation.

In addition, CMO supports formal combined FCAs/PCAs scheduled and conducted by ESDIS. These audits are conducted to validate that each ECS CI is in conformance with its functional and performance requirements defined in the technical documentation. The FCAs/PCAs validate that:

- The as-built configuration compares directly with the documented configuration identification represented by the detailed CI specifications.
- Test results verify that each ECS product meets its specified performance requirements to the extent determinable by testing.
- The as-built configuration being shipped compares with the final tested configuration. Any differences between the audited configuration and the final tested configuration are documented.
- When not verified by test, the compatibility of ECS products with interfacing products or equipment is established by comparison of documentation with the interface specifications which apply.
- COTS products are included in FCAs and PCAs as integral parts of the ECS baseline.

# Abbreviations and Acronyms

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ABL	Allocated Baseline
ACI	Allocated Configuration Identification
BOO	Business Operations Office
BOE	Bases of Estimate
CCB	Change Control Board (Hughes Convention) or Configuration Control Board (NASA Convention)
CCR	Configuration Change Request
CDMTS	Configuration/Data Management Tracking System
CDR	Critical Design Review
CDRD	Contract Data Requirements Document
CDRL	Contract Data Requirements List
CI	Configuration Item
CIL	Configuration Item List
CM	Configuration Management
CMWG	Configuration Management Working Group
CMO	Configuration Management Organization
CMP	Configuration Management Plan
CO	Contracting Officer
COTR	Contracting Officer's Technical Representative
COTS	Commercial Off the Shelf
CPL	Computer Program Library
CSA	Configuration Status Accounting
CSR	Consent to Ship Review
DAAC	Distributed Active Archive Centers
DCN	Document Change Notice
DDTS	Distributed Defect Tracking Software
DID	Data Item Description
DM	Data Management
DMO	Data Management Organization



DOD	Department of Defense
ECMP	ECS Configuration Management Plan
ECS	EOSDIS Core System
EDF	ECS Development Facility
EDHS	ECS Data Handling System
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
EP	Evaluation Package
ESDIS	Earth Science Data and Information System
FBL	Functional Baseline
FCA	Functional Configuration Audit
FCI	Functional Configuration Identification
FOS	Flight Operations Segment
GFE	Government Furnished Equipment
GSFC	Goddard Space Flight Center
HAC	Hughes Aircraft Corporation
HCE	Hardware Configuration Engineer
HITC	Hughes Information Technology Corporation
HTSC	Hughes Technical Services Company
I&T	Integration and Testing
IATO	Independent Acceptance Test Organization
ICD	Interface Control Document
IDR	Incremental Design Review
ILS	Integrated Logistics Support
IR	Interim Release
IRD	Interface Requirement Document
ITO	Integration and Test Organization
IV&V	Independent verification and validation
M&O	Maintenance and Operations
NASA	National Aeronautical and Space Administration
NCR	Nonconformance Report

NRCA	Nonconformance Reporting and Corrective Action
ORR	Operations Readiness Review
PA	Product Assurance
PAIP	Performance Assurance Implementation Plan
PBL	Product Baseline
PCA	Physical Configuration Audit
PCI	Product Configuration Identification
PDR	Preliminary Design Review
PI	Project Instruction
QO	Quality Office
RDW	Request for Deviation/Waiver
RIR	Release Initiation Review
ROM	Rough Order of Magnitude
RRR	Release Readiness Review
RTM	Requirements and Traceability Management
SCDO	Science and Communications Development Office
SCF	Science Computing Facility
SCM	Software Configuration Management or Subcontracts Management Organization
SDF	Software Development File
SDL	Software Development Library
SDPS	Science Data Processing Segment
SDR	System Design Review
SDS	Segment Design Specification
SMO	System Management Office
SMC	System Monitoring and Coordinating Center or System Management Center
SOW	Statement of Work
SRR	System Requirements Review
TAO	Test and Acceptance Organization
TIP	Technical Information Program
TRR	Test Readiness Review
VCATS	Vendor Costing and Tracking System

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# Glossary

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**Baseline** — A configuration identification document or a set of such documents formally designated by the Government at a specific time during a CI's life cycle. Baselines, plus approved changes from those baselines, constitute the current approved configuration identification.

**Build** — An assemblage of threads that produces a gradual buildup of system capabilities. Builds are combined with other builds and threads to produce higher-level builds.

**Class I Change** — Changes that impact ECS Project-level milestones, budget, costs, and requirements. Class I changes may not be implemented until approved by the Earth Science Data and Information System (ESDIS) change control board.

**Class II Change** — Engineering changes which are not defined as Class I changes (e.g. changes in documentation to correct errors or add clarifying notes). Class II changes may be approved by the ESDIS Project COTR and Flight Assurance Manager, or their designated representative

**Commercial off-the-shelf (COTS)** — COTS is a product, such as an item, material, software, component, subsystem, or system, sold or traded to the general public in the course of normal business operations at prices based on established catalog or market prices.

**Configuration** — The functional and physical characteristics of hardware, firmware, software or a combination thereof as set forth in technical documentation and achieved in a product.

**Configuration Change Request (CCR)** — A document that requests and justifies a change to a configuration item.

**Configuration Control** — The systematic proposal, justification, evaluation, coordination, approval or disapproval of proposed changes, and the implementation of all approved changes in the configuration of a CI after formal establishment of its baseline.

**Configuration Item (CI)** — An aggregation of hardware, firmware, software, or any of its discrete portions, which satisfies an end use function and is designated for configuration control. CIs are those items whose performance parameters and physical characteristics must be separately defined (specified) and controlled to provide management insight needed to achieve the overall end use function and performance.

**Computer program library** — A library designated to establish and maintain software in media form. The computer Program library handles, stores, and manages master magnetic media and related data..

**Configuration Change Control** — Configuration Change Control is the systematic coordination, evaluation and release of approved changes to an established baseline.

**Consent to Ship Review (CSR)** — Review to determine the readiness of a release for transition to sites for integration testing.

**Critical Design Review (CDR)** — A detailed review of the element/segment-level design, including such details as program design language for key software modules, and element interfaces associated with a release.

**Data Archive and Distribution System (DAAC)** — A detailed review of the element/segment-level design, including such details as program design language for key software modules, and element interfaces associated with a release.

**Deviation** — A written request to depart temporarily (for a specific period of time or number of units) from the authorized baseline requirements (i.e., a temporary or limited waiver).

**Emergency Fix** — A change installed and documented in controlled hardware or software with the responsible CCB's (or designated representative's) approval, but separate from a formally released change.

**Evaluation Package (EP)** — An evaluation package is a delivery mechanism for incrementally developed components and selected prototypes. The objectives of evaluation packages are to increase user involvement in system evolution and rapid evaluation and to facilitate rapid incorporation of user feedback into the incremental development process.

**Formal Development Track** — A development process distinguished by a complete tree of requirements documentation, formal reviews at major milestones in the development cycle and a single waterfall of phases leading to a formal release. The single waterfall has a long time frame relative to the incremental development track and prototypes.

**Formal Release** — A formal Release is a system-wide update to the ECS, delivered and tested as a part of the EOSDIS. ECS Releases will represent the ECS portion of EOSDIS Versions. Formal releases are part of the formal development track.

**Functional Configuration Audit (FCA)** — The formal examination of functional characteristics of a CI, prior to acceptance, to verify that the item has achieved the performance specified in its functional or allocated configuration identification.

**Hardware** — That combination of subcontracted, commercial-off-the-shelf (COTS), and Government Furnished Equipment (GFE) (e.g., cables and computing machines that are the platforms for software).

**Incremental Development Track** — A development process distinguished by multiple iterations of requirements, design, and implementation with frequent user evaluations via demonstrations. Documentation and reviews are streamlined. Documentation of non-mission critical functions is created after the development has completed. Each increment is developed with the potential of being integrated into the formal track for a release. The incremental development track has a cycle time between the formal development and prototypes.

**Independent Verification and Validation (IV&V)** — Verification and validation performed by a contractor or government agency that is not responsible for developing the product or performing the activity being evaluated. IV&V is an activity that is conducted separately from the software development activities governed by the ECS contract.

**Interim Release** — The delivery of system capability resulting from early efforts on the formal track development to the customer for testing of EOS functionality prior to an operational version.

**Nonconformance** — The failure of a unit or product to conform to specified requirements.

**On-site SDL** — Both common and site specific software released for operational use are maintained in the On-site Software Development Library (SDL) located at each site. The On-site SDL also contains the Master Index of configuration items (hardware, COTS, documentation) developed by ECS and residing at that specific site.

**Physical Configuration Audit (PCA)** — The formal examination of the "as-built" configuration of a CI against its technical documentation to establish the CI's initial product configuration identification (PCI).

**Preliminary Design Review** — PDR is held for each ECS Segment. The PDR addresses the design of the segment-level capabilities and element interfaces through all ECS releases. The PDR also addresses prototyping results and how the results of both Contractor and Government prototyping efforts, studies, and user experience with EOSDIS Version 0 have been incorporated into the ECS design for each respective Segment.

**Product Baseline** — The baseline which establishes the "as-built" configuration for system-level integration and testing and independent acceptance testing. This baseline is validated by functional and physical configuration audits, and reviewed and approved by GSFC as part of RRR.

**Prototype** — Prototypes are focused developments of some aspect of the system which may advance evolutionary change. Prototypes may be developed without anticipation of the resulting software being directly included in a formal release. Prototypes are developed on a faster time scale than the incremental and formal development tracks.

**Release Readiness Review** — Conducted at the ECS system level for a GSFC project review team upon completion of release acceptance testing. The Independent Acceptance Test Organization leads the RRR to determine, with the Government Acceptance Test Team and the Contracting Officer's Technical Representative, if the release is ready to be delivered, installed, and incorporated into the operational system.

**Segment** — One of the three functional subdivisions of the ECS: (1) CSMS — Communications and Systems Management Segment, (2) FOS — Flight Operations Segment, and (3) SDPS — Science Data Processing Segment

**Software Development Library (SDL)** — A generic term which describes a controlled collection of software, documentation, and associated tools and procedures used to simplify the development and subsequent support of software. An SDL provides storage of and controlled access to software in both human readable and machine readable form. Also, it may contain management data pertinent to the software development project.

**Software** — A combination of associated computer instructions and computer data definitions required to enable the computer hardware to perform computational, data manipulation, and control functions (to include parameters and procedures associated with software products).

**Software Development File** — A repository for a collection of material pertinent to the development or support of software. Contents typically include (either direct or by reference) design considerations and constraints, design documentation and data, schedule and status information, test requirements, test cases, test procedures, and test results.

**System Requirement Review (SRR)** — The SRR encompasses a complete review of the ECS specification and the EOS/EOSDIS Requirements (Level 2) that drive the specification, it promotes a common understanding between the Project and the Contractor of the capabilities that ECS must provide.

**Thread** — A thread consists of a set of components (software, hardware and data) and operational scenarios that implement a function or a set of functions.

**Versions** — Versions are the culmination of a series of ECS Releases, in conjunction with incorporation of SCF-developed science data processing software and unique site capabilities.

**Waiver**—A written authorization to accept a configuration item that departs from specific requirements but considered suitable for use "as is" or after rework by an approved method.